PAN-PACIFIC ENTOMOLOGIST
January 1982, Vol. 58, No. 1, pp. 38–41

# INSECT SEED PREDATION ON *ASTRAGALUS BISULCATUS* (HOOK.) GRAY (LEGUMINOSAE)[1]

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A few *Astragalus* (Leguminosae) species assume special significance in the intermountain region of western United States and Canada because they are highly poisonous to livestock. The poisonous nature of these plants is associated with their ability to accumulate large (>1000 ppm) quantities of selenium (Se) (Trelease and Martin, 1936; Rosenfeld and Beath, 1964). One such poisonous plant, *A. bisulcatus* (Hook.) Gray, is a widely distributed perennial species in the intermountain region (Barneby, 1964).

Although the phytochemistry of *A. bisulcatus* has been the subject of several studies (see Nigram and McConnell, 1969; Chow et al., 1971), there is only one published account of insect seed predation on this species. In this publication, Trelease and Trelease (1937) found that the seeds from an *A. bisulcatus* population located near Laramie, Wyoming were heavily infested with a bruchid, *Acanthoscelides fraterculus* (Horn), and a seed-chalcid identified as a *Bruchophagus* species (probably *mexicanus* (Ashmead)). These investigators were surpsied to find insects completing their development on *A. bisulcatus* seeds containing about 1475 ppm of Se, especially in view of the known toxicity of seleniferous vegetation to various mammals and arthropods such as red spiders (Gnadinger, 1933) and aphids (Hurd-Karrer and Poos, 1936).

The present study was designed to assess the relative intensity of insect seed predation in 4 Wyoming populations of *A. bisulcatus*. We document the potential role of insect seed predators on the population dynamics of *A. bisulcatus* because this poisonous weed seems to be spreading along seleniferous horizons in and east of Grand Teton National Park (GTNP). Moreover, *A. bisulcatus* has become well established on newly reclaimed areas of a uranium mine in the Powder River Basin of Wyoming (J. D. Love, pers. comm.).

## Methods and Study Areas

A collection consisting of one randomly selected raceme from 7 plants was made in the Gros Ventre Canyon (lower site), 2.5 km east of the GTNP boundary on July 26, 1978. In 1979, collections were taken at this site on July 19, 27 and August 19. Collections were taken at 3 additional sites in 1979: Gros Ventre Canyon (upper site), 6.1 km east of GTNP boundary (sampled July 27); 2.4 km northeast of Wolff Ranch, GTNP (sampled July 20); and 24.2 km NW Dubois (sampled July 27 along Hwy. 26). Each 1979 collection consisted of one raceme from 10 plants although in 2 instances (Wolff Ranch collection and July 27 collection at the lower site in Gros Ventre Canyon) it was difficult finding one intact raceme per plant because of high seed predation by rodents. It appeared that these rodents were indiscriminate in their selection of seed pods.

The lower and upper Gros Ventre Canyon and Dubois study sites were small (<0.2 ha) roadside areas, each supporting about 20–50 scattered plants. At the Wolff Ranch site an undetermined number of plants (<100) were distributed for a few hundred meters along a small ridge that overlooked a large meadow to the north. *A. bisulcatus* plants at each site were found on dry gravelly, seleniferous soils.

Samples were returned to a laboratory at the Ohio Agricultural Research and Development Center (OARDC) where fully developed seed pods from each raceme were individually dissected to determine the extent of insect seed predation. Mean percentage seed predation values (±SD) for each collection were calculated from 7 or 10 replicates of one raceme each.

## Results and Discussion

An average of 68.5 ± 18.5% of the seed pods collected in Gros Ventre Canyon (lower site) on July 26, 1978 were infested with larvae of the anthomyiid fly, *Hylemya anane* (Walker). In 1979, seed pod infestation rates of this fly were uniformly high in all collections: 66.3 ± 23.1% and 89.5 ± 7.1% in the July 19 and 27 collections, respectively, at the lower site in Gros Ventre Canyon; 72.2 ± 28.3% in the collection from the upper site in Gros Ventre Canyon; 61.7 ± 22.1% in the Wolff Ranch collection; and 79.5 ± 23.0% in the Dubois collection. Each of these infested pods contained one developing *H. anane* larva and this larva consumed, or at least destroyed, all the seeds within the pod (Fig. 1). An additional collection was taken on August 19 at the lower site in Gros Ventre Canyon, but by this date most of the insect seed predators had vacated their seed pods; however, dissections of all the pods revealed a seed pod infestation rate of 82.4 ± 14.3%. The mean number of seed pods per raceme ranged from a low of 16.1 ± 8.6 (August 19 collection, lower site in Gros Ventre Canyon) to a high of 29.1 ± 14.6 (Dubois collection).

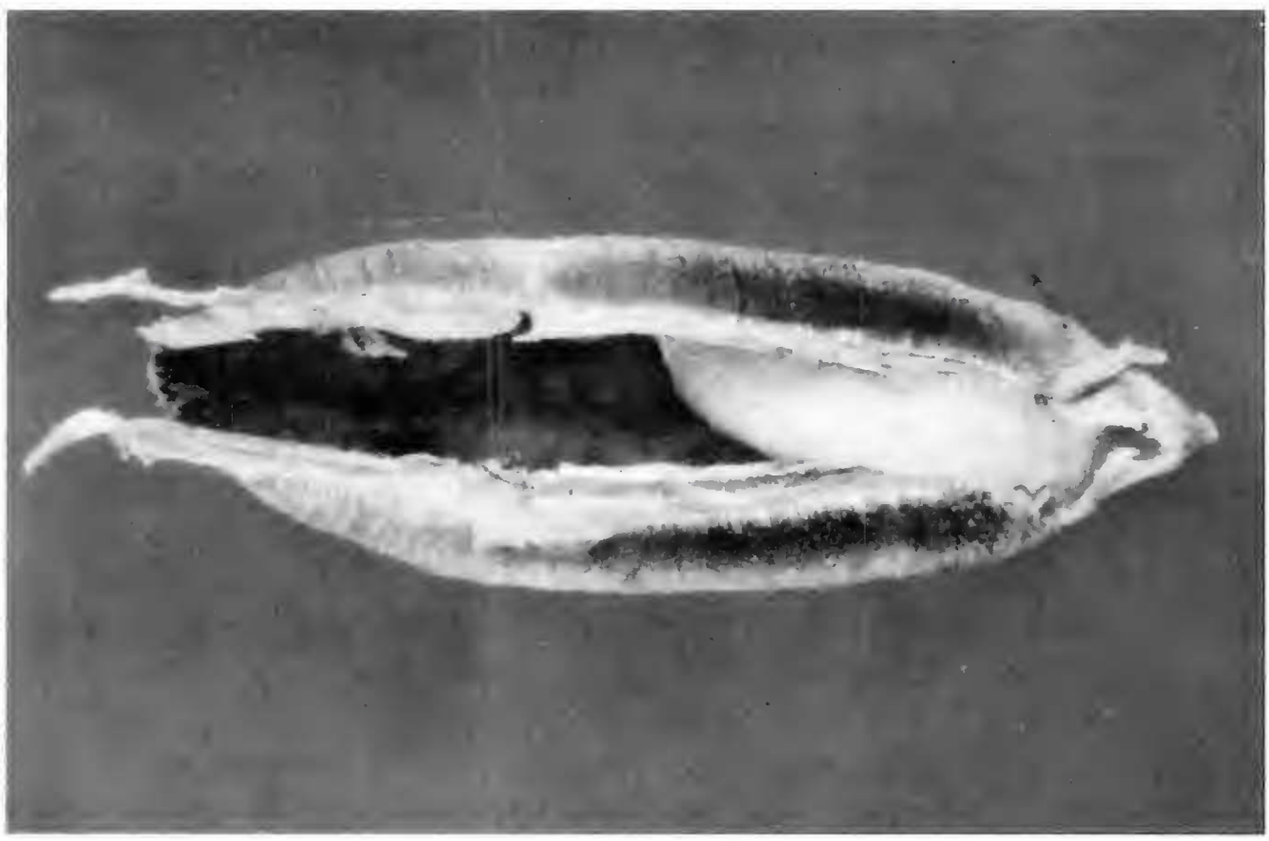

Fig. 1. Larva of *Hylemya anane* within a seed pod of *Astragalus bisulcatus*.

An unidentified seed chalcid wasp was responsible for additional seed destruction. However, our only estimate of the amount of damage caused by this wasp was obtained by dissecting the seeds in 45 randomly selected seed pods from the July 27, 1979 Gros Ventre Canyon (lower site) collection. In this sample, a developing chalcid larva was found in 8 of 74 (10.8%) mature seeds that were dissected. All attempts to rear larvae to adults failed.

Heretofore, nothing has appeared in the literature concerning the biology of *H. anane* or closely related species (G. Steyskal, pers. comm.). Thus, biological aspects of *H. anane* gleaned from our study are noteworthy. For instance, observations on the development of this species in an outdoor screenhouse at OARDC between early August 1978 and late June 1979 suggest that *H. anane* is univoltine and has an obligatory diapause. In this context, larvae vacated their seed pods in late August to pupate on the soil surface (3 cm deep) in rearing containers (1 qt ice cream cartons). Adults emerged from overwintering pupae during May and June.

Hymenopterous parasitoids attacked *H. anane* in Wyoming. These parasitoids were recovered from screenhouse rearing containers in late August 1978 and early May 1979, and sent to the USDA Systematic Entomology Laboratory in Washington, D.C., where they were identified as *Chlorocytus* sp. and *Halticoptera* sp. (Pteromalidae).

The selenium in *A. bisculcatus* seeds does not prevent substantial pre-

dispersal seed destruction by at least 3 insect species in several Wyoming populations. In addition, insect seed predators readily attack at least 2 other *Astragalus* species whose foliage is toxic to livestock: *A. cibarius* Sheld. by a bruchid beetle (*Acanthoscelides fraterculus* Horn), a seed weevil (*Tychius soltaui* Casey), a seed chalcid (*Bruchophagus mexicanus* Ashmead), stink bugs (*Chlorochroa uhleri* Stål, *C. ligata* Say), and lepidopterous larvae (*Glaucopsyche lygdamus* Dbldy., *Strymon melinus* Hübner) (Green and Palmbald, 1975); and *A. pectinatus* Dougl. ex Hook. by a fly (probably *Pseudotephritis* sp.) (see Moxon, 1939).

## Acknowledgments

We are indebted to Dr. J. D. Love for his support and encouragement with this study. We thank Drs. B. Bowman, S. Duffey, A. Moxon, and R. Rust for general assistance, and Mr. G. Steyskal and Dr. E. Grissell, USDA Systematic Entomology Laboratory, for taxonomic assistance.

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## Footnotes

[1] Approved for publication as Journal Article No. 119-80 of the Ohio Agricultural Research and Development Center, Wooster 44691.

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